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L5: Entry 1 of 1

File: USPT

May 2, 2000

DOCUMENT-IDENTIFIER: US 6056903 A

TITLE: Preparation of polyethersulfone membranes

Abstract Text (1):

A method for making a skinless essentially symmetrical hydrophobic polysulfone microporous membrane by the steps of (a) forming a casting solution containing (i) a dissolved polyethersulfone polymer, (ii) a solvent for the polyethersulfone polymer, and (iii) a lower aliphatic glycol; (b) coating a substrate with the casting composition; (c) exposing the coated substrate to atmospheric conditions; (d) passing the exposed coated substrate into a precipitation bath to precipitate the membrane, the precipitation bath containing a lower aliphatic glycol and water; (e) rinsing the membrane; and (f) drying the membrane.

Brief Summary Text (2):

The present invention relates to the preparation of skinless essentially symmetrical hydrophobic microporous polyethersulfone membranes which are useful in materials separations by filtration, dialysis, and the like, and as supports and containment media for materials, and related uses.

Brief Summary Text (11):

It is an object of this invention to produce essentially unskinned and symmetrical polyethersulfone membranes from stable polymer mixes, which membranes have flow rate and throughput properties at least as good as prior art membranes in a range of pore sizes and with easily controlled process parameters. It is another object to produce a hydrophilic polyether sulfone membrane having very low extractables.

Brief Summary Text (13):

The present invention is directed to a method for making a skinless, essentially symmetrical, hydrophobic polysulfone microporous membrane by (a) forming a casting solution containing (i) a dissolved polyethersulfone polymer, (ii) a solvent for the polyethersulfone polymer, and (iii) an aliphatic glycol; (b) coating a substrate with the casting composition; (c) exposing the coated substrate to atmospheric conditions; (d) passing the exposed coated substrate into a precipitation bath to precipitate the membrane, the precipitation bath containing an aliphatic glycol and water; (e) rinsing the membrane; and (f) drying the membrane.

Brief Summary Text (15):

The method enables one skilled in the art to make a skinless hydrophobic microporous polysulfone membrane with desired pore diameters and bubble points by controlling (i) the composition of the casting solution, (ii) the time the coated substrate is exposed to atmospheric conditions before entering the precipitation bath, and (iii) the composition of the precipitation bath. The entire method can be carried out at room temperature, and as such is simpler than known methods for preparing polyethersulfone membranes which require careful monitoring and control of temperature.

Brief Summary Text (33):

The thin layer of casting solution then enters into an aliphatic glycol precipitation bath. The composition of this bath is key to achieving the essentially symmetrical skinless structures. Generally the precipitation bath is prepared from the same aliphatic glycol used to prepare the casting solution, although a different glycol can be used in whole or in part. In addition preferably the precipitation bath contains a small amount of water or other strong non-solvent such as ethanol, methanol, or the like. Adding about 10% water to the precipitation bath has been found to speed up membrane formation, i.e. reduce the time for the membrane to set up completely. Adding more than about 20% has been found to start to cause undesirable skin formation on the exposed surface. As the water (or other strong non-solvent) content is increased, the microporous membrane quickly becomes more asymmetric and eventually becomes skinned as the level rises.

Current US Cross Reference Classification (1):210/500.41

## CLAIMS:

1. A method of making a skinless, essentially symmetrical, hydrophobic, polysulfone microporous membrane comprising:

(a) forming a casting solution containing (i) a dissolved polyethersulfone polymer, (ii) a solvent for the polyethersulfone polymer and (iii) an aliphatic glycol having about 2 to about 20 carbon atoms, at a temperature that is sufficiently low that the casting solution is stable;

(b) coating a substrate with the casting solution;

(c) exposing the coated substrate to atmospheric conditions;

(d) passing the exposed coated substrate into a precipitation bath to precipitate the membrane, the precipitation bath predominantly containing an aliphatic glycol having about 2 to about 20 carbon atoms and water; and

(e) rinsing the membrane; and

(f) drying the membrane.

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1. Document ID: US 6565748 B1

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File: USPT

May 20, 2003

US-PAT-NO: 6565748

DOCUMENT-IDENTIFIER: US 6565748 B1

TITLE: Cationically charge-modified membranes

DATE-ISSUED: May 20, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Wang; I-fan	San Diego	CA		
Zepf; Robert	Solana Beach	CA		

US-CL-CURRENT: 210/500.38; 210/500.29, 210/500.36, 210/500.37, 210/500.41,  
210/500.42, 264/41, 264/48, 264/49

Full	Title	Citation	From	Review	Classification	Date	Reference	Claims	TOHC	Drawn
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2. Document ID: US 6540915 B2

L4: Entry 2 of 28

File: USPT

Apr 1, 2003

US-PAT-NO: 6540915

DOCUMENT-IDENTIFIER: US 6540915 B2

TITLE: Antimicrobial semi-permeable membranes

DATE-ISSUED: April 1, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Patil; Arvind S.	Davidson	NC		

US-CL-CURRENT: 210/500.27; 210/484, 210/500.23, 210/500.28, 210/500.29, 210/500.36,  
210/500.38, 210/500.41, 210/500.42

Full	Title	Citation	From	Review	Classification	Date	Reference	Claims	TOHC	Drawn
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3. Document ID: US 6056903 A

L4: Entry 3 of 28

File: USPT

May 2, 2000

US-PAT-NO: 6056903

DOCUMENT-IDENTIFIER: US 6056903 A

TITLE: Preparation of polyethersulfone membranes

DATE-ISSUED: May 2, 2000

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Greenwood; John M.	Newton	MA		
Johnson; James S.	Acton	MA		
Witham; Michael J.	Grafton	MA		

US-CL-CURRENT: 264/41; 210/500.41, 427/244, 427/245, 521/64 Full  Title  Citation  Front  Back  Classification  Date  Reference    Claims  KINIC  Drawn 4. Document ID: US 6045694 A

L4: Entry 4 of 28

File: USPT

Apr 4, 2000

US-PAT-NO: 6045694

DOCUMENT-IDENTIFIER: US 6045694 A

TITLE: Cationically charge-modified membranes

DATE-ISSUED: April 4, 2000

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Wang; I-fan	San Diego	CA		
Zepf; Robert	Solana Beach	CA		

US-CL-CURRENT: 210/500.37; 210/500.27, 210/500.35, 210/500.36, 210/500.38,  
210/500.41, 210/500.42, 264/41, 264/48, 264/49 Full  Title  Citation  Front  Back  Classification  Date  Reference    Claims  KINIC  Drawn 5. Document ID: US 5885456 A

L4: Entry 5 of 28

File: USPT

Mar 23, 1999

US-PAT-NO: 5885456

DOCUMENT-IDENTIFIER: US 5885456 A

TITLE: Polysulfone copolymer membranes and process

DATE-ISSUED: March 23, 1999

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Charkoudian; John	Carlisle	MA		
Allegrezza, Jr.; Anthony E.	Milford	MA		

US-CL-CURRENT: 210/500.41; 210/500.27, 210/500.35

Full	Title	Citation	From	Review	Classification	Date	Reference			Claims	KINIC	Drawn
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## □ 6. Document ID: US 5695640 A

L4: Entry 6 of 28

File: USPT

Dec 9, 1997

US-PAT-NO: 5695640

DOCUMENT-IDENTIFIER: US 5695640 A

TITLE: Hydrophilized porous article

DATE-ISSUED: December 9, 1997

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Tseng; Hsiao-Show	Stamford	CT		

US-CL-CURRENT: 210/500.38; 210/490, 210/500.27, 210/500.36, 210/500.4, 210/500.41

Full	Title	Citation	From	Review	Classification	Date	Reference			Claims	KINIC	Drawn
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## □ 7. Document ID: US 5496637 A

L4: Entry 7 of 28

File: USPT

Mar 5, 1996

US-PAT-NO: 5496637

DOCUMENT-IDENTIFIER: US 5496637 A

TITLE: High efficiency removal of low density lipoprotein-cholesterol from whole blood

DATE-ISSUED: March 5, 1996

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Parham; Marc E.	Bedford	MA		
Duffy; Richard L.	Cambridge	MA		
Nicholson; Donald T.	Leominster	MA		

US-CL-CURRENT: 428/376; 210/500.23, 210/500.35, 210/500.41, 428/398

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Dra
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**□ 8. Document ID: US 5160626 A**

L4: Entry 8 of 28

File: USPT

Nov 3, 1992

US-PAT-NO: 5160626

DOCUMENT-IDENTIFIER: US 5160626 A

**\*\* See image for Certificate of Correction \*\***

TITLE: Blotting methods using polyaldehyde activated membranes

DATE-ISSUED: November 3, 1992

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Pemawansa; Kariyawasam P. W.	Ann Arbor	MI		
Heisler; Mark D.	Saline	MI		
Kraus; Menahem	Rehovot			IL

US-CL-CURRENT: 210/538; 204/296, 210/500.41, 435/180

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Dra
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**□ 9. Document ID: US 5096585 A**

L4: Entry 9 of 28

File: USPT

Mar 17, 1992

US-PAT-NO: 5096585

DOCUMENT-IDENTIFIER: US 5096585 A

TITLE: Process for preparing protein non-adsorptive microporous polysulfone membranes

DATE-ISSUED: March 17, 1992

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Nguyen; Thanh D.	Billerica	MA		

US-CL-CURRENT: 210/500.23; 210/500.41, 264/177.15

Full	Title	Citation	Front	Review	Classification	Date	Reference	Claims	KWIC	Dra
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**□ 10. Document ID: US 5085777 A**

L4: Entry 10 of 28

File: USPT

Feb 4, 1992

US-PAT-NO: 5085777

DOCUMENT-IDENTIFIER: US 5085777 A

\*\* See image for Certificate of Correction \*\*

TITLE: Reverse osmosis membranes of polyamideurethane

DATE-ISSUED: February 4, 1992

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Arthur; Samuel D.	Wilmington	DE		

US-CL-CURRENT: 210/500.38; 210/500.41, 264/41, 264/DIG.48, 264/DIG.62

Full	Title	Citation	From	To	Classification	Date	Reference	Claims	KWD	Draw
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L5: Entry 1 of 1

File: USPT

May 2, 2000

US-PAT-NO: 6056903

DOCUMENT-IDENTIFIER: US 6056903 A

TITLE: Preparation of polyethersulfone membranes

DATE-ISSUED: May 2, 2000

## INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Greenwood; John M.	Newton	MA		
Johnson; James S.	Acton	MA		
Witham; Michael J.	Grafton	MA		

US-CL-CURRENT: 264/41; 210/500.41, 427/244, 427/245, 521/64         

L4 and symmetrical

1

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<u>L3</u>	L2 and 11	3	<u>L3</u>
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<u>L1</u>	microporous polysulfone same membrane	198	<u>L1</u>

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**Term:** L4 and symmetrical

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L3	L2 and 11	3	<u>L3</u>
L2	210/500.22.ccls.	50	<u>L2</u>
L1	microporous polysulfone same membrane	198	<u>L1</u>

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